

ABSTRACT OF THE INVENTION

An improved LOCOS method for forming a patterned silicon dioxide field region on a substrate assembly by implanting silicon ions into a silicon substrate. The implanted silicon ions partially randomize the lattice structure of the monocrystalline silicon in the silicon substrate and increase the availability of silicon to ambient oxygen, thus increasing the rate of oxidation of the silicon substrate. The implantation of the silicon substrate with silicon ions makes oxidation faster and reduces the formation of bird's beak structures, as compared to an unimplanted silicon substrate. The method may also incorporate a nitride spacer formed at a periphery of an opening in the silicon nitride hard mask. The nitride spacer decreases straggle and the dimension of the resultant silicon dioxide field region, such that the dimensions thereof are below photolithography resolution limits. An improved shallow trench isolation region is also taught and reduces cross-talk and allows active regions to be formed closer together. The improved shallow trench isolation region is formed with a method that includes implanting silicon ions into an isolation trench followed by formation of a thermal oxide in the isolation trench that has greater lateral dimensions at the bottom of the isolation trench than at the top. A layer of silicon nitride is deposited to fill the remainder of the isolation trench and form the shallow trench isolation region.

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